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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/604,060	06/24/2003	Richard A. Conti	FIS920030135US1	1059
29371	7590	06/25/2004	EXAMINER	
CANTOR COLBURN LLP 55 GRIFFIN ROAD SOUTH BLOOMFIELD, CT 06002			ROCCHEGIANI, RENZO	
			ART UNIT	PAPER NUMBER
			2825	

DATE MAILED: 06/25/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Applicant(s)</b> 10/604,060	<b>Applicant(s)</b> CONTI ET AL.	
	<b>Examiner</b> Renzo N. Rocchegiani	<b>Art Unit</b> 2825	

**-- The MAILING DATE of this communication appears on the cover sheet with the corresponding address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 05 May 2004.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-23 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-23 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Claim Objections***

1. Claim 16 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claim 16 broadens the scope of claim 15 by adding ammonia to the group of precursor gases that may be used to generate the atomic hydrogen species.

### ***Claim Rejections - 35 USC § 102***

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1 and 8-14 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 5,930,655 (Cooney, III et al.) ("Cooney").

Cooney discloses a process to denude fluorine from a dielectric layer the process comprising after the CMP step of a metal and fluorine-containing dielectric wire structure (Fig. 3), generating atomic hydrogen species and exposing the fluorine-

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containing dielectric to the atomic hydrogen species so as to lower the amount of fluorine from the dielectric material. (col. 6, lines 35-45) The atomic hydrogen species are generated via a plasma or heating process in a furnace wherein a hydrogen-bearing compound such as hydrogen or hydrogen and an inert gas is used. (col. 6, lines 35-44). The metal layer may comprise copper. (col. 3, lines 35-45). The fluorine-containing dielectric, such as SiOF, is completely denuded of fluorine. (col. 5, lines 22-28 and col. 6, lines 59-62).

4. Claim 23 is rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No. 6,433,432 B2 (Shimizu).

Shimizu discloses a process to form a wiring structure comprising a copper conductor and a fluorine-containing dielectric wherein the fluorine-containing layer (item 5) is deposited and patterned to form vias that are to be filled with copper material (item 9) and planarized to form damascene structures (Fig. 3C-F), forming a plasma from a hydrogen bearing gas such as ammonia to generate atomic hydrogen species together with nitrogen gas (col. 5, lines 10-15) and exposing the fluorine-containing dielectric to the hydrogen species thereby removing the fluorine from the surface of the fluorine-containing material. (Fig. 3F and col. 5, lines 1-10).

***Claim Rejections - 35 USC § 103***

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 2-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,930,655 (Cooney, III et al.) ("Cooney").

As stated in paragraph 3, all the limitations of these claims have been met except for specifying that the fluorine is removed in at least about 700 angstroms or less or equal to 20 percent of the dielectric layer thickness.

While Cooney does not specify the thickness of the dielectric from which the fluorine is removed such a limitation would be obvious to one with ordinary skill in the specific art since such a variation would only require a mere change in size and a change in size is generally recognized as being within the level of ordinary skill in the art. *In re Rose*, 105 SUPQ 237 (CCPA 1955).

7. Claims 15-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,433,432 B2 (Shimizu) in view of U.S. Patent Application Publication No. 2002/0063312 A1 (Towle et al.).

Shimizu discloses a process to form a wiring structure comprising a copper conductor and a fluorine-containing dielectric wherein the fluorine-containing layer (item 5) is deposited and patterned to form vias that are to be filled with copper material (item 9) and planarized to form damascene structures (Fig. 3C-F), forming a plasma from a hydrogen bearing gas such as ammonia to generate atomic hydrogen species and exposing the fluorine-containing dielectric to the hydrogen species thereby removing the fluorine from the surface of the fluorine-containing material. (Fig. 3F and col. 5, lines 1-10).

Shimizu does not disclose the use of hydrogen gas to generate atomic hydrogen species. Shimizu also does not specify that the fluorine is removed in at least about 700 angstroms or less or equal to 20 percent of the dielectric layer thickness.

Towle et al. teach the removal of fluorine from a dielectric by exposing it to atomic hydrogen species created in a plasma where the atomic hydrogen species may be obtained from either ammonia or hydrogen gas. [0019]

It would have been obvious to one with ordinary skill in the specific art to use hydrogen as opposed to ammonia, since Towle et al. explicitly teach that these two precursor gases are interchangeable in this process.

Furthermore, while Shimizu does not specify the thickness of the dielectric from which the fluorine is removed such a limitation would be obvious to one with ordinary skill in the specific art since such a variation would only require a mere change in size and a change in size is generally recognized as being within the level of ordinary skill in the art. *In re Rose*, 105 SUPQ 237 (CCPA 1955).

### ***Response to Arguments***

8. Applicant's arguments filed on May 5, 2004 have been fully considered but they are not persuasive. Before addressing the arguments the examiner points out that claim 16 now stands objected to because it is no longer further limiting. Applicant is respectfully asked to make the appropriate correction. With respect to claim 1, and the claims dependent thereon, applicant argues the prior art does not anticipate the limitation of claim 1 because the Cooney reference teaches a heat treatment and thus no atomic hydrogen species are present. The examiner directs applicant's attention to

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column 2, lines 58-62 of the Cooney reference where it is disclosed that a plasma may be induced during the heat treatment. Furthermore, the Cooney reference also refers to the heat treatment as an activated heat treatment. In light of this evidence, the examiner remains convinced that atomic hydrogen species will be present in the heat treatment of the Cooney reference thus the limitations of claim 1 are anticipated and the rejection stands as previously presented. With respect to claim 23, applicant argues that the Shimizu reference does not teach the use of nitrogen gas. The examiner directs applicant's attention to column 5, lines 10-15 of the Shimizu reference where it is disclosed that ammonia is introduced together with nitrogen gas. Thus, this limitation is met and this claim also remains rejected as previously presented. With respect to claim 15, and the claims dependent thereon, the applicant presents the arguments that, as amended, claim 15 is not anticipated by Shimizu because it requires one of the listed precursor gases that Shimizu does not disclose. The examiner agrees with applicant's arguments, nonetheless the claim stands rejected as obvious in light of Towle et al., another reference that was cited in the 892 with the previous office action. The Towle et al. reference discloses that hydrogen gas, i.e. one of the precursor gases listed in amended claim 15, is interchangeable with ammonia, i.e. the gas used in Shimizu. Thus, in light of Towle et al., the examiner avers that the limitations contained in claim 15 are rendered obvious. Therefore, claim 15 and the claims depending thereon, stand rejected but under an obviousness rejection as opposed to the previously presented anticipation rejection.

***Conclusion***

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Renzo N. Rocchegiani whose telephone number is (571)272-1904. The examiner can normally be reached on Mon.-Fri. 8:00 am - 5 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on (571)272-1907. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.



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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Renzo N. Rocchegiani  
Examiner  
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A handwritten signature in black ink, appearing to read "M. Smith", with a stylized flourish at the end.

MATTHEW SMITH  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 2800